Foreword to the Special Issue on Laser and optical technologies in biomedicine and ecology

Dear Colleagues,

It is our pleasure to present you the Special Issue of the [Journal of Biomedical Photonics & Engineering](#) (J-BPE) with selected papers of the Biophotonics Workshop of the XVI [All-Russian Youth Samara Conference-Contest on Optics and Laser Physics](#) (Samara, November 13-17, 2018). The conference-contest was organized by P.N. Lebedev Physical Institute (Samara Branch) and Samara National Research University and supported by Russian Foundation for Basic Research (grant No. 18-32-10033), Administration of Samara Region and Samara SPIE Student Chapter.

The Biophotonics Workshop is one of the most interesting workshops of the Conference. The papers presented in the Special Issue of J-BPE cover a broad range of topics on applications of laser and optical techniques for solving of biomedical problems.

In their study, [Anna Neupokoeva](#) and co-authors from Irkutsk State Medical University and Irkutsk Technical National University analyzed the changes of an insulin solution's structure under the influence of 650 nm laser radiation. The researchers used nanometer resolution probe microscope for analyses of insulin crystallograms. Also they performed correlation processing of speckle patterns obtained by passing laser radiation through the solution. It was shown that laser radiation promoted solution homogenization. So the authors believe that the laser effect is important for improving insulin effectiveness in the body and reducing insulin consumption.

The aim of the paper of [Lubov Kokorina and Anna Neupokoeva](#) (Irkutsk State Medical University) was to investigate the effect of laser irradiation on the activity of plant pharmaceuticals. In particular, the authors supposed that laser radiation facilitated destruction of the solutions clusters into components and thus would increase the biochemical activity of the drugs. They observed the different bacteria growth dynamics for pre-irradiated and non-irradiated pharmaceuticals.

[Kristina Ganichkina](#) and co-authors (Samara National Research University) experimentally studied the properties of porous silicon as well as nanocomposites on its base with hydroxyapatite. The authors analyzed IR spectra of material samples with glucose and hydroxyapatite. They concluded that porous silicon is promising material for glucose biosensors. And also the researchers believe that nanocomposites porous silicon - hydroxyapatite suitable biomaterial for osteoplasty.

Various silicon nanostructures, for example nanowires, mesoporous nanoparticles and others, obtained by plasma-chemical synthesis and laser-ablation methods were investigated by [Alida Alykova](#) and co-authors from National Research Nuclear University MEPhI, Lomonosov Moscow State University and Lebedev Physical Institute. On the base of Raman spectra, the researchers studied the dissolution in water of various types of particles. Depending on the rates of dissolution

they gave recommendations for the use of each type of nanoparticle for specific biomedical applications.

The team of researchers from Saratov State University, Tomsk State University, Saratov State Medical University, Institute of Precision Mechanics and Control RAS, ITMO University and Samara National Research University **Ekaterina Lazareva** and others presented the development of multi-wavelength refractometric technique for estimating the degree of skin dehydration when using optical clearing agents such as glycerol and glucose. The researchers conducted *in vitro* and *in vivo* measurements in the visible and NIR spectral regions. They demonstrated the differences in the dehydration of healthy skin and skin with tumor. Thus the developed technique is promising as a new diagnostic and monitoring method for oncological diseases.

Ananastasia Ustinova, Ivan Bratchenko, and Dmitry Artemyev (Samara National Research University) suggested six-level skin model for the Monte Carlo simulation of human skin autofluorescence in different spectral ranges. Detailed analyze of literature data allowed the authors to identify some main fluorophores for every skin layer and on the base of known values of their absorption and scattering coefficients as well as fluorescence properties simulate the fluorescence spectra exited by radiation at different spectral regions. The authors compared their model autofluorescence spectra with experimental data obtained by other researchers. They concluded that the proposed model of human skin autofluorescence is correct enough to use in further studies.

Thus, the collected papers of the Special Issue demonstrate potential of optical and laser technologies and also the application of nanomaterials in different biomedical studies and applications.

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